**Learning scenario with MARG - Template**

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| **PART 1: General information**  |
| **Title of the scenario:** | A CO2-neutral future |
| **Keywords:** | Energy transition |
| **Name(s) of the scenario’s creator(s):** | C. Gerlich & M.L. van Zwol, Nl-DNC |
| Creative Commons License **of the scenario:** | [ ] Attribution | [ ] Attribution-NoDerivs |
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| [X] Attribution-NonCommercial-ShareAlike | [ ] Attribution-NonCommercial-NoDerivs |
| **Estimated duration of the scenario’s activities:** | 180 minutes |
| **Age range of learners:** | 12-15 years old |
| **Learners’ special characteristics: (i.e. immigrants, special needs)** | none |
| **Learning subject based on your curriculum to which the scenario relates:** | Energy and environment |
| **To which Sustainable Development Goal (s) does the scenario relate to : (highlight it/them)** | [ ] No Poverty | [ ] Industry, Innovation and infrastructure |
| [ ] Zero Hunger | [ ] Reduced Inequalities |
| [ ] Good Health and Well-Being | [X] Sustainable Cities and Communities |
| [ ] Quality Education | [X] Responsible Consumption and Production |
| [ ] Gender Equality | [X] Climate Action |
| [ ] Clean Water and Sanitation | Life Below Water |
| [X] Affordable and Clean Energy | [X] Life On Land |
| [ ] Decent Work and Economic Growth | [ ] Peace, Justice and Strong Institutions |
|  | Partnerships For The Goals |
| **Which 21st century skill(s) does the scenario involve:****(highlight it/them)** | [X] Information and data literacy  | [ ] Critical thinking,  |
| [X] Communication | [X] Active citizenship |
| [X] Collaboration | [X] Respect for differences |
| [X] Problem solving |  |

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| **PART 2: Learning outcomes of the scenario**  |
| **In terms of knowledge**  | The learner knows and understands:* The new forms of energy, as well as the old ones
* The impact of sustainable development on their life
* Ways of incorporating sustainability into their everyday life
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| **In terms of skills** | The learner is able to:* Formulate arguments for and against the use of different forms of fules sources.
* Collaborate with team mates, answer the questions in each step and make wise choices.
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| **In terms of competences** | The learner:* Gains knowledge to live sustainably and be energy conscious
* Is able to contribute to CO2 emmision reduction
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| **PART 3: Description of the game** |
| **Narrative description of the game plot:** | Game players are expected to [1] collect information about earlier energy forms and collect enough energy for Liam and Simone to travel through time from the past to the near future. Furthermore players are expected to [2] collect materials (objects) so Liem and Simone can make their house as sustainable as possible and are able to use a sustainable mode of transport. The aim for Liam and Simone is to live as sustainable as possible (in the near future).  |
| **Game objectives:** | [1] To travel through time with Liam and Simone the student have to collect information about past energy usage (peat, gas from coal, natural gas). With this information students can pose arguments for and against using these older forms of energie and earn ‘fuel’ for the time machine to travel from scene 1 to 5 to 3 to 8. [2] Liam and Simone can collect materials for their future or scene 2,4 and 6 t/m 10. They can do this after answering questions, reading a tekst, looking at a video and/or other actions. These scenes are not always available on the map of the game. For a 100% score on transport at a minimum one should have a battery, charger and car because the other materials are useless without those. The house can be charged to a 100% when insulation material (floor, cavity wall, windows, roof), heat exchanger, solar panels, heat pump and a solar water heater are collected.The objective is to achieve the highest conceivable energy score so Liam and Simone can live most comfortably.  |
| **Does the scenario refer to a specific location? If yes, specify. If no, write everywhere.** | Yes, a cycle path through Assen along different locations highlighting different steps of energy transition.  |
| **Characters:** | Liam and Simone |
| **Scenes:** | The game contains 10 locations:1. Drents archive – peat extraction (history)
2. Ellen – living energy neutral in an existing appartement
3. NAM – natural gas and oil extraction in the Netherlands (current/history)
4. Stadhouderslaan – new buildings that are energy efficient and free of natural gas
5. Gasfabriek Assen (Gas plant) – Extraction of gas out of coal (history)
6. Diepstroeten – living energy consious
7. TT-circuit – solar park and motor cycle parking space
8. Duurzaamheidscentrum (sustainability centre) – sustainability in practice (education)
9. Van der Valk – Tesla superchargers
10. Carpoolplaats Kloosterveen – charging stations
11. BMW-dealer – electric cars
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| **Type of work: Individual/ collaboration** | Students play in groups of 3 or 4 |
| **Does the game involve different player roles? If yes, specify.** | no |

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| **PART 4: Description of the learning scenario activities** |
|  | **Learning settings** | **Estimated time** |
| **Before the game:** | Parents are informed that the students will participate in an extracurricular activity on their bikes during class via email. Without counter notice we assume that the parents give their consent. The subject of living an energy efficient life is brought up in the class in an interactive way to the stundets: they discuss for a few minutes in groups what being energy concious means to them. The game objectives are introduced to the students in a written or an oral format. Students are instructed to download the app on their phone and play the game. Additionally they are divided into teams to play the game.  | 15’ |
| **During the game:** | All groups start from school. The route has to be programmed so the route can be cycled clockwise and counterclockwise. The groups will start every 5 minutes starting alternately left and right. Taking the order of scenes mentioned above:Scene 1: The Drents Archief contains a lot of information about peat extraction in Drenthe. This information has be reviewed and could be supplemented or replaced by a youtube-movie. After studying the material, arguments for and against using peat as a fuel source have to be “formulated”. With 3 good arguments against will gain enough “time travel fuel’ to unlock scene 5.Scene 5: At the location where the former gas plant was located students will gain information about the history of gas extraction from coal, using this gas and the soil pollution that consequently happened. After studying the material, arguments for and agains using gas from coal as a fuel source have to be “formulated”. With 3 good arguments against will gain enough “time travel fuel’ to unlock scene 3. Scene 3: At the NAM students will be informed about the activities of the NAM in the past, present and future. After studying the material, arguments for and against using gas as a fuel source have to be “formulated”. With 3 good arguments against will gain enough “time travel fuel’ to unlock scene 8.  |  |
|  | Scene 2: At the Ellen students will receive information within the app about the idea behind renovating this flat. After reviewing the information two questions have to be answered. Doing this will allow students to pick up objects. Only a selection of these objects are useful for the ultimate goal.Scene 4: At the Stadhouderslaan the students can observe houses from the outside. In the app they can point out which sustainable means can be discerned (possibly supplemented with pictures). The items they discern can be added to their inventory (maybe by dropping something from their inventory like doubles or useless items)Scene 6: At the Diepstroeten the students can observe houses from the outside. In the app they can point out which sustainable means can be discerned (possibly supplemented with pictures). The items they discern can be added to their inventory (maybe by dropping something from their inventory like doubles or useless items)Scene 7: The TT-circuit has solar panels that double as motorcycle parking spaces. After reviewing the information various multiple choice questions have to be answered. Every time a question is answered correctly an object can be picked up. Only a selection of these objects are useful for the ultimate goal. (maybe by dropping something from their inventory like doubles or useless items)Scene 9: At the Van der Valk multiple Tesla superchargers are located. At the scene students are informed through the app about the charging speed, charging capacity and range of the Tesla’s. Supplying the right information gives a charger for a Tesla (object) (useless item) for new transport. Scene 10: At the carpool place Kloosterveen electric chargers are located. At the scene students are informed through the app about which cars can make use of these chargers and the specifications of the chargers. Supplying the right information gives a charger for a BMW (object) for new transport. Scene 11: The BMW-dealer sells electric cars. A description of the difference between (to be decided) gives an electric car (object).  | 120’ |
| **After the game:** | Every team can make a choice in which “sustainable items” they will use. Every sustainable item provides a percentage of CO2-reduction. Through discussion the team should figure out which items yield the most CO2-reduction. The team that goes from 100% to 0% gets a certificate.  | 45’ |
|  | **Total**: |  |

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| **PART 5: Prerequisite knowledge and supportive material** |
| **Learners’ prerequisite knowledge:** | Know how to install an app on your phone and basic knowledge of sustainable energy. |
| **Infrastructure/ equipment needed for implementing the scenario:** | Mobile phone with data |
| **Other learning resources needed:** |  |

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| **PART 6: Approach towards the assessment of the learning outcomes** |
| **Learners’ assessment approach:** | * Questions within the game
* Knowing which sustainable items yield the bigger CO2-reduction total.
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